Appendix A: Specifications

This appendix contains specifications for the TDS3000B Series oscilloscopes. All specifications are guaranteed unless noted as "typical." Typical specifications are provided for your convenience but are not guaranteed. Specifications that are marked with the ✓ symbol are checked in *Appendix E: Performance Verification*.

All specifications apply to all TDS3000B Series models unless noted otherwise. To meet specifications, two conditions must first be met:

- The oscilloscope must have been operating continuously for twenty minutes within the operating temperature range specified.
- You must perform the Compensate Signal Path operation described on page 1–4. If the operating temperature changes by more than 10° C, you must perform the Compensate Signal Path operation again.

Specifications

Acquisition		
Acquisition modes	Sample (Normal), Peak detect, Envelope, and Average	
Single Sequence	*Acquisition mode*	*Acquisition stops after*
	Sample, Peak Detect	One acquisition, all channels simultaneously
	Average, Envelope	N acquisitions, all channels simultaneously, N is settable from 2 to 256 (or ∞ for Envelope)

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Specifications (cont.)

Inputs				
Input coupling	DC, AC, or GND Channel input remains terminated when using GND coupling.			
Input impedance, DC coupled	1 MΩ ±1% in parallel with 13 pF ±2 pF, TekProbe compatible 50 Ω ±1%; VSWR ≤ 1.5:1 from DC to 500 MHz, typical			
Maximum voltage at input BNC (1 MΩ)	*Overvoltage category*	*Maximum voltage*		
	CAT I Environment (refer to page A–14)	150 V_{RMS} (400 V_{pk})		
	CAT II Environment (refer to page A–14)	100 V_{RMS} (400 V_{pk})		
	For steady-state sinusoidal waveforms, derate at 20 dB/decade above 200 kHz to 13 V_{pk} at 3 MHz and above.			
Maximum voltage at input BNC (50 Ω)	5 V_{RMS} with peaks ≤ ±30 V			
Maximum floating voltage	0 V from chassis (BNC) ground to earth ground, or 30 V_{RMS} (42 V_{pk}) only under these conditions: no signal voltages >30 V_{RMS} (>42 V_{pk}), all common leads connected to the same voltage, no grounded peripherals attached			
Channel-to-channel crosstalk, typical	Measured on one channel, with test signal applied to another channel, and with the same scale and coupling settings on each channel			
	Frequency range	*TDS3012B TDS3014B*	*TDS3032B TDS3034B*	*TDS3052B TDS3054B*
	≤ 100 MHz	≥ 100:1	≥ 100:1	≥ 100:1
	≤ 300 MHz	—	≥ 50:1	≥ 50:1
	≤ 500 MHz	—	—	≥ 30:1

Specifications (cont.)

Inputs				
Differential delay, typical	100 ps between any two channels with the same scale and coupling settings			
Vertical				
Number of channels	*TDS3012B, TDS3032B, TDS3052B*		*TDS3014B, TDS3034B, TDS3054B*	
	2 plus external trigger input		4 plus external trigger input	
Digitizers	9-bit resolution, separate digitizers for each channel, sampled simultaneously			
SCALE Range (at BNC)	*1 MΩ*		*50 Ω*	
	1 mV/div to 10 V/div		1mV/div to 1 V/div	
Fine SCALE	Adjustable with ≥ 1% resolution			
Polarity	Normal and Invert			
Position range	±5 divisions			
⩘ Analog bandwidth, 50 Ω (also typical at 1 MΩ with standard probe)	Bandwidth limit set to Full, operating ambient ≤30 °C, derate 1%/°C above 30 °C			
	Scale range	*TDS3012B TDS3014B*	*TDS3032B TDS3034B*	*TDS3052B TDS3054B*
	5 mV/div to 1 V/div	100 MHz	300 MHz	500 MHz
	2 mV/div to 4.98 mV/div	100 MHz	250 MHz	300 MHz
	1 mV/div to 1.99 mV/div	90 MHz	150 MHz	175 MHz
Calculated rise time, typical	—	3.5 ns	1.2 ns	0.7 ns

Specifications (cont.)

Vertical		
Analog bandwidth limit, typical	Selectable between 20 MHz, 150 MHz (not available on TDS3012B or TDS3014B), or Full	
Lower frequency limit, AC coupled, typical	7 Hz for 1 MΩ, reduced by a factor of ten when using a 10X passive probe; 140 kHz for 50 Ω	
Peak detect or Envelope pulse response, typical	Minimum width of pulse with amplitude of ≥2 div to capture 50% or greater amplitude	
	Sample rates ≤125 MS/s	*Sample rates ≥250 MS/s*
	1 ns	1/sample rate
DC gain accuracy	± 2%, derated at 0.025%/°C for temperatures below +18° C and above +30° C, in Sample or Average acquisition mode	
DC measurement accuracy	*Measurement type*	*DC Accuracy (in volts)*
Sample acquisition mode, typical	Absolute measurement of any waveform point, and High, Low, Max, and Min measurements.	± [0.02[1] × | reading – (offset – position) | + offset accuracy + 0.15 div + 0.6 mV]
	Delta voltage between any two points on a waveform, and all other automatic measurements.	± [0.02[1] × | reading | + 0.15 div + 1.2 mV]
Average acquisition mode (≥16 averages)	Absolute measurement of any waveform point, and High, Low, Max, and Min measurements.	± [0.02[1] × | reading – (offset – position) | + offset accuracy + 0.1 div]
	Delta voltage between two points on a waveform, and all other automatic measurements.	± [0.02[1] × | reading | + 0.05 div]

1 0.02 term (gain component) derated at 0.00025/°C above 30° C

Specifications (cont.)

Vertical				
Offset range	*Scale range*		*Offset range*	
	1 mV/div to 9.95 mV/div		±100 mV	
	10 mV/div to 99.5 mV/div		±1 V	
	100 mV/div to 995 mV/div		±10 V	
	1 V/div to 10 V/div		±100 V	
Offset Accuracy	*Scale range*	*Accuracy*		
	1 mV/div to 100 mV/div	± [0.002 × | net offset | +1.5 mV + (0.1 div × V/div setting)]		
	101 mV/div to 1 V/div	± [0.0025 × | net offset | +15 mV + (0.1 div × V/div setting)]		
	1.01 V/div to 10 V/div	± [0.0025 × | net offset | +150 mV + (0.1 div × V/div setting)]		
Horizontal				
Acquisition (horizontal) resolution	*Normal* (10,000 point record)		*Fast trigger* (500 point record)	
Maximum acquisition rate, typical	*TDS3012B TDS3014B*	*TDS3032B TDS3034B TDS3052B TDS3054B*	*TDS3012B TDS3014B*	*TDS3032B TDS3034B TDS3052B TDS3054B*
	400 wfms/s	700 wfms/s	2,600 wfms/s	3,600 wfms/s
Sample rate range	*TDS3012B TDS3014B*	*TDS3032B TDS3034B*	*TDS3052B TDS3054B*	
Normal	100 S/s to 1 GS/s	100 S/s to 2.5 GS/s	100 S/s to 5 GS/s	
Fast trigger	5 S/s to 1.25 GS/s	5 S/s to 2.5 GS/s	5 S/s to 5 GS/s	
Seconds/division range	4 ns/div to 10 s/div	2 ns/div to 10 s/div	1 ns/div to 10 s/div	

Specifications (cont.)

Horizontal		
✓ Sample rate and delay time accuracy	±20 ppm over any ≥1 ms time interval	
Trigger		
External trigger input, typical	TDS3012B, TDS3032B, TDS3052B: 1 MΩ in parallel with 17 pF, TekProbe compatible TDS3014B, TDS3034B, TDS3054B: 1 MΩ in parallel with 52 pF, not Tekprobe compatible	
External trigger maximum voltage	*Overvoltage category*	*Maximum voltage*
	CAT I Environment (refer to page A–14)	150 V_{RMS} (400 V_{pk})
	CAT II Environment (refer to page A–14)	100 V_{RMS} (400 V_{pk})
	For steady-state sinusoidal waveforms, derate at 20 dB/decade above 200 kHz to 13 V_{pk} at 3 MHz and above.	
External trigger maximum floating voltage	0 V from chassis (BNC) ground to earth ground, or 30 V_{RMS} (42 V_{pk}) only under these conditions: no signal voltages >30 V_{RMS} (>42 V_{pk}), all common leads connected to the same voltage, no grounded peripherals attached	
✓ Edge trigger sensitivity	*Source*	*Sensitivity*
	Any channel, DC coupled	0.35 div from DC to 50 MHz, increasing to 1 div at oscilloscope bandwidth
Edge trigger sensitivity, typical	External trigger	100 mV from DC to 50 MHz, increasing to 500 mV at 300 MHz
	External/10 trigger	500 mV from DC to 50 MHz, increasing to 3 V at 300 MHz
	Any channel, NOISE REJ coupled	3.5 times the DC-coupled limits

Specifications (cont.)

Trigger		
Edge trigger sensitivity, typical	Any channel, HF REJ coupled	1.5 times the DC-coupled limit from DC to 30 kHz, attenuates signals above 30 kHz
	Any channel, LF REJ coupled	1.5 times the DC-coupled limits for frequencies above 80 kHz, attenuates signals below 80 kHz
Trigger level range	*Source*	*Sensitivity*
	Any channel	±8 divisions from center of screen, ±8 divisions from 0 V if LF REJ trigger coupled
	External external	±800 mV
	External/10 trigger	±8 V
	Line	Fixed at the midlevel of the AC line
SET LEVEL TO 50%, typical	Operates with input signals ≥45 Hz	
Trigger level accuracy, typical	*Source*	*Sensitivity*
	Any channel	±0.2 divisions
	External trigger	±20 mV
	External/10 trigger	±200 mV
	Line	N/A
Trigger holdoff range	250.8 ns to 10 s	

Specifications (cont.)

Trigger		
Video trigger sensitivity, typical	Triggers on negative sync of NTSC, PAL, or SECAM signal	
	Source	*Sensitivity*
	Any channel	0.6 to 2.5 divisions of video sync tip
	External trigger	150 mV to 625 mV of video sync tip
	External/10 trigger	1.5 V to 6.25 V of video sync tip
B Trigger	*Trigger After Time*	*Trigger After B Events*
Range	13.2 ns to 50 s	1 event to 9,999,999 events
Minimum time between arm and trigger, typical	5ns from the end of the time period and the B trigger event	5 ns between the A trigger event and the first B trigger event
Minimum Pulse Width, typical	—	B event width, 2 ns
Maximum Frequency, typical	—	B event frequency, 250 MHz

Specifications (cont.)

Display	
Display screen	6.5 in (165 mm) diagonal color liquid crystal
Display resolution	640 horizontal by 480 vertical pixels
Backlight intensity, typical	200 cd/m^2
Display color	Up to 16 colors, fixed palette
External display filter	Scratch-resistant tempered glass
I/O ports	
Ethernet port	10BaseT RJ-45 female connector (all models)
Parallel printer port	Centronics compatible, DB-25 female connector
GPIB interface	Available in optional accessory TDS3GV
RS-232 interface	DB-9 male connector, available in optional accessory TDS3GV, TDS3EM
VGA signal output	DB-15 female connector, 31.6 kHz sync rate, EIA RS-343A compliant, available in optional accessory TDS3GV
Probe compensator output, typical	5.0 V into ≥1 MΩ load, frequency = 1 kHz
Miscellaneous	
Nonvolatile memory	Typical retention time ≥ 5 years for front-panel settings, unlimited for saved waveforms and setups
Floppy disk	3.5 in, DOS format, 720 KB or 1.44 MB compatible
Internal clock	Provides date/time stamp for stored data and the current time and date to the front panel, if enabled.

Specifications (cont.)

Power sources	
AC line power	Operates the oscilloscope and charges the optional internal battery
Source voltage	90 V_{RMS} to 250 V_{RMS}, continuous range
Source frequency	47 Hz to 440 Hz
Power consumption	75 W maximum
Battery power	Optional accessory TDS3BATNIMH, rechargeable NiMH battery pack
Operating time, typical	2 hours, depending on operating conditions
Battery charge time, typical	18 hours in the oscilloscope, 3 hours in the optional external charger TDS3CHG
Line fuse	Internal, not user replaceable
Environmental	
Temperature	Operating range (no disk installed): +5 °C to +50 °C Nonoperating range (no disk installed): –20 °C to +60 °C Typical operating range for floppy disks: +10 °C to +50 °C
Humidity	Operating range (no disk installed): 20% to 80% RH below 32 °C, derate upper limit to 21% RH at 50 °C Nonoperating range (no disk installed): 5% to 90% RH below 41 °C, derate upper limit to 30% RH at 60 °C Typical operating range for floppy disks: 20% to 80% RH below 32 °C, derate upper limit to 21% RH at 50 °C
Pollution Degree	Pollution Degree 2: Typical home or office environment

Specifications (cont.)

Environmental	
Altitude	Operating limit: 3000 m Nonoperating limit: 15,000 m
Random vibration	Operating: 0.31 g_{RMS} from 5 Hz to 500 Hz, 10 minutes on each axis Nonoperating: 2.46 g_{RMS} from 5 Hz to 500 Hz, 10 minutes on each axis
Drop resistance, typical	Survives a 152 mm (6 in) drop onto concrete with only cosmetic damage
Mechanical	
Size	Height: 176 mm (6.9 in), 229 mm (9.0 in) including handle Width: 375 mm (14.75 in) Depth: 149 mm (5.9 in)
Weight	Oscilloscope only: 3.2 kg (7.0 lbs) With accessories and carry case: 4.1 kg (9.0 lbs) When packaged for domestic shipment: 5.5 kg (12.0 lbs) Optional battery pack: 2.4 kg (5.2 lbs)

Specifications (cont.)

EMC certifications and compliances	
EMC Compliance: European Union	Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EN 61326 EMC requirements for Class A electrical equipment for measurement, control, and laboratory use [1,2] IEC 61000-4-2 Electrostatic discharge immunity (Performance criterion B) IEC 61000-4-3 RF electromagnetic field immunity (Performance criterion B)[3] IEC 61000-4-4 Electrical fast transient/burst immunity (Performance criterion B) IEC 61000-4-5 Power line surge immunity (Performance criterion B) IEC 61000-4-6 Conducted RF immunity (Performance criterion B)[4] IEC 61000-4-11 Voltage dips and interruptions immunity (Performance criterion B) EN 61000-3-2 AC power line harmonic emissions

Specifications (cont.)

EMC certifications and compliances	
EMC Compliance: Australia/New Zealand	Meets the intent of Australian EMC Framework as demonstrated to the following specification: AS/NZS 2064.1/2
EMC Compliance: Russia	This product was certified by the GOST ministry of Russia to be in compliance with all applicable EMC regulations.
FCC Compliance: U.S.A.	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits

1 **Emissions that exceed the levels required by this standard may occur when this equipment is connected to a test object.**

2 **To ensure compliance to the standards listed above, attach only high quality shielded cables to this instrument. High quality shielded cables typically are braid and foil types that have low impedance connections to shielded connectors at both ends.**

3 **The increase in trace noise while subjected to a test field (3 V/m over the frequency range 80 MHz to 1 GHz, with 80% amplitude modulation at 1 kHz) is not to exceed 6 major dvisions peak-to-peak. Ambient conducted fields may induce triggering when the trigger threshold is offset less than 3 major divisions from ground reference.**

4 **The increase in trace noise while subjected to a test field (3 V/m over the frequency range 150 kHz to 80 MHz, with 80% amplitude modulation at 1 kHz) is not to exceed 4 major dvisions peak-to-peak. Ambient conducted fields may induce triggering when the trigger threshold is offset less than 2 major divisions from ground reference.**

Specifications (cont.)

Safety certifications and compliances	
EC Declaration of Conformity – Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 73/23/EEC as ammended by 93/68/EEC
(TDS3000B Series, P3010, and P6139A)	EN 61010-1/A2:1995 Safety requirements for electrical equipment for measurement, control, and laboratory use
(P3010 and P6139A)	EN 61010-2-031:1995 Particular requirements for hand-held probe assemblies for electrical measurement and test equipment
Approvals	
(TDS3000B Series, P3010, and P6139A)	UL3111-1 – Standard for electrical measuring and test equipment CAN/CSA C22.2 No. 1010.1 – Safety requirements for electrical equipment for measurement, control and laboratory use
(P3010 and P6139A)	EN 61010-2-031:1995 – Particular requirements for hand-held probe assemblies for electrical measurement and test equipment
Installation Category Descriptions	Terminals on this product may have different installation category designations. The installation categories are: CAT III – Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location CAT II – Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected CAT I – Secondary (signal level) or battery operated circuits of electronic equipment

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